VoIP Best Practices

Contents

Purpose

The purpose of the VoIP Best Practices is to provide state agencies with the planning resources necessary for management and technology staff to facilitate successful VoIP implementation.

In addition to providing technical and operational suggestions to consider before deploying VoIP, the Best Practices utilize the Texas Project Delivery Framework as a tool for managing a VoIP implementation. Because of this, this document can serve as a practical Project Management template for assessing and managing a VoIP Project.

DIR welcomes your input and suggestions to continually update these Best Practices. Forward your suggestions to Lon Berquist, Telecommunications Division, (lon.berquist@dir.state.tx.us)

Approach

The best practice documents are garnered from actual VoIP implementations on the Capitol Complex and from other state agency implementations.

The Best Practices highlight recommended practices and tools for:

- Project Management and Planning
- VoIP Readiness
- Network Security
- Network Performance
- Change Management
- Risk Mitigation

1	Management & Planning			
	DESCRIPTION		ISSUES	
	Management and Planning include the business, financing, and administration of an IP telephony project from inception to post-implementation evaluation.		• Major Information Resources Projects (defined in § 2054.003 of Government Code) have specific requirements under statute that must be addressed (See § 2054.118). For more information review the Texas Project Delivery Framework Quick Reference at http://www.dir.state.tx.us/pubs/framework/overview.htm • Before Implementing a VoIP Project, review the VoIP Best Practices to consider every aspect of VoIP Projects (Planning, Technical, and Training).	
1.1	**Project Initiation**			
	DESCRIPTION		ISSUES	
	Project Initiation develops the Project Charter which formally establishes the project. The Charter should include the Business Case, Return on Investment, High Level Scope, and Project Goals and Objectives, Assumptions and constraints, and funding source.		There are a variety of Business Cases for VoIP depending on the type of implementation; VoIP to the desktop, Hybrid IP-PBX systems, IP Telephony for toll bypass, VoIP for remote users, etc. Management should consider future needs and the quick pace of IP telephony when considering VoIP implementation.	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
1.1.1	**Project Charter**	A project charter formally recognizes the existence of the project. All projects must have a project charter. Project Charter should include: • Business Case • ROI (High Level) • Scope (Draft, High Level) • Project Goals and Objectives • Assumptions and Constraints • Funding Project charter should also designate a Project Manager (PM) and define the PM's authority level.	• VoIP Project Team should consult with internal agency Project Management Office (if you have one) for any agency specific planning documents, tools or templates. • The Project Management Institute (PMI) offers the professional Project Management Program and Certificate and publishes articles and information on Project Planning. The Project Management Body of Knowledge (PMBOK) provides Project Management guidance. http://www.pmi.org/prod/groups/public/documents/info/pp_stnd_productexcerpts.asp • Major Information Resources Projects are required to use the Texas Delivery Framework). Information available on the DIR Web site: http://www.dir.state.tx.us/pubs/framework/ • The Framework provides templates for	• Review any internal agency project management policies and practices • Discussion of PMI Standards are available at PMI publications site: http://www.pmi.org/info/PP_Standards_Overview.asp?nav=0503 • Review Statues related to Major IT Projects http://www.dir.state.tx.us/pubs/framework/submission.htm#quickref

			Business Case and Project Charter to assist in managing a large IT project. http://www.dir.state.tx.us/pubs/framework/ • Building a Business Case for VoIP http://www.ciscopress.com/articles/article.asp?p=336256&rl=1 • IT Business Case Template: Voice over Internet Protocol (VoIP) Solutions (ZDNet) http://storage.itpapers.com/whitepapers/case/voipmakethecase.doc • IP Telephony Business Case Tool (Nortel) http://www167.nortelnetworks.com/input.asp	
1.2	**Project Planning**			
	DESCRIPTION		ISSUES	
	Project Planning defines the scope of the VoIP project and addresses staffing, scheduling, and budget constraints.		• A VoIP Project becomes more technically complex as the number of users and sites are increased. • Network Assessment must be completed before Final Project Plan is complete.	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
1.2.1	**Scope Statement**	The scope statement provides a basis for the common understanding of the scope of the project among all stakeholders. Same as the scope of work or statement of work. Detailed Scope highlighting: • Number of Sites • Number of End Users • LAN and/or WAN utilization • Connection of Remote Sites/Users • Potential for Facilities Expansion and Upgrade Costs	Project Definition Guide (Nortel) http://www.nortelnetworks.com/solutions/iptelephony/5steps/step4.html	
1.2.2	**Work Breakdown Structure (WBS) and Task Descriptions**	WBS breaks the project into smaller, more manageable work packages, shows a hierarchy for these work packages. The	• The Framework provides a Project Plan template that includes tools for Project Organization and Work Breakdown.	

		WBS also organizes and defines the total scope of work. It includes: • Names • Resources – Voice Staff, Data Network Staff, LAN Staff, WAN Staff, Project Manager, Inventory Staff, Accounting Staff The task descriptions are designed to control what work is done and when. They establish boundaries on what is included in the task and what is not.	http://www.dir.state.tx.us/pubs/framework/gate2/projectplan/index.htm • Organizational Guidelines for IP Telephony (Forrester) http://www.forrester.com/Research/Document/Excerpt/0,7211,36289,00.html	
1.2.3	**Work Diagram**	Shows how the project tasks will flow from beginning to end. Created by putting the project tasks or work packages in their order of completion from project beginning to end. Includes: Tasks & Sequence	The Framework provides tools and information for Project Planning that includes all activities for Project Planning http://www.dir.state.tx.us/pubs/framework/gate2/projectplan/index.htm	
1.2.4	**Schedule**	Schedule must include contingency time for any significant Network Readiness in response to Network Assessment.	The Framework provides tools and information for Project Planning that includes all activities for Project Planning http://www.dir.state.tx.us/pubs/framework/gate2/projectplan/index.htm	
1.2.5	**Budget**	Budget must address Network Readiness upgrade costs after completion of Network Assessment.	The Framework provides tools and information for Project Planning that includes all activities for Project Planning http://www.dir.state.tx.us/pubs/framework/gate2/projectplan/index.htm	
1.2.6	**Communications Management**	Communications Management includes determining the information and communications needs of the stakeholders. It should be a formal and written plan to establish what information needs to be communicated to whom, how, and when. All stakeholders should be included in the communications management plan.	The Framework provides a template for Communication Management that includes methods for management of formal communications for a project. http://www.dir.state.tx.us/pubs/framework/gate2/commplan/index.htm	

1.2.7	**Risk Management**	Risk management includes the processes involved with identifying, analyzing, and responding to risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events. The six steps of risk management are: 1. Risk Management planning 2. Risk Identification 3. Qualitative Risk Analysis 4. Quantitative Risk analysis 5. Risk response planning 6. Risk monitoring and control Project Risk should address all functional, financial, and technical issues related to both Voice and Data Networking.	• The Framework provides a template for Risk Management that includes methods for identification, analysis, quantification, monitoring, and control of project risks. http://www.dir.state.tx.us/pubs/framework/gate2/riskplan/index.htm • Network Evaluation and Risk Assessment Guide (Nortel) http://www.nortelnetworks.com/solutions/iptelephony/5steps/step4.html	
1.2.8	**Control System**	Project team should develop/use a system for tracking and monitoring changes to the project.	The Framework Project Planning document provides information addressing the Monitoring and Control of Projects. http://www.dir.state.tx.us/pubs/framework/gate2/projectplan/index.htm	
1.2.9	**Final Project Plan**	Final Project Plan should adopt technical requirements for Network Readiness after Network Assessment.	The Framework provides a Project Plan template that includes all activities for Project Planning. http://www.dir.state.tx.us/pubs/framework/gate2/projectplan/index.htm	
1.3	**Project Execution**			
	DESCRIPTION		ISSUES	
	Project Execution includes carrying out the Project Plan and completing activities highlighted in Project Plan.		Coordination and communication between agency staff and outside vendors is crucial for VoIP Project implementation. Internal coordination and communication among Voice, Data Networking (LAN & WAN) staff is required for successful VoIP Project Execution.	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
1.3.1	**Execute Project Plan**	Actively manage the project to the project plan.		

1.3.2	**Solicitation & Contracting**	• Review DIR's IT Commodity Purchasing Program Guidelines http://www.dir.state.tx.us/commodities/program.htm • Review TBPC Contract Management Guide http://www.tbpc.state.tx.us/stpurch/contractguide.html	• DIR's IT Commodity Purchasing Program Guidelines http://www.dir.state.tx.us/commodities/program.htm • TBPC Contract Management Guide http://www.tbpc.state.tx.us/stpurch/contractguide.html • The Framework provides an Acquisition Plan Template. http://www.dir.state.tx.us/pubs/framework/gate3/acquisition/index.htm • The Framework provides template for Contract Amendment and Change Order Approval. http://www.dir.state.tx.us/pubs/framework/gate3/contractchange/index.htm	• § 2054.008 Contract Notification – any major information system costing more than $100,000 must provide written notice to the LBB regarding the project. http://www.capitol.state.tx.us/statutes/docs/GV/content/htm/gv.010.00.002054.00.htm
1.3.3	**Manage Project**	Project Management requires cooperation and communication among Voice and Data Networking Management and Staff.	• The Framework Project Planning gate includes tools for ongoing management of projects. http://www.dir.state.tx.us/pubs/framework/gate2/index.htm • Project Implementation tools are included in Framework. http://www.dir.state.tx.us/pubs/framework/gate4/index.htm	
1.4	**Project Control**			
	DESCRIPTION		ISSUES	
	Project Performance, whether in-house or out-sourced, must be monitored and measured periodically to limit variance from Project Plan.		Shared responsibilities among Voice and Data Networking staff must be managed carefully. Agency Liaison(s) with outside Vendor must maintain continuous monitoring and contact.	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
1.4.1	**Performance Measures & Reporting**	Because Voice and Data are business critical functions, project performance	• Review Framework Performance Management Tools	

		measures must be reported at appropriate time periods.	http://www.dir.state.tx.us/pubs/framework/gate2/performplan/index.htm • Review Framework Monitoring Tools. http://www.dir.state.tx.us/pubs/framework/gate2/monitor/index.htm	
1.4.2	**Scope Verification**	Initial Scope Verification may be significantly impacted by Network Assessment and subsequent requirements for Network Readiness. PM and project team need to ensure that the project includes all the work and only the work required to successfully complete the project. Nearly 3 out of 4 projects do not come in on time and on budget. Spending extra hours and dollars completing tasks that are not part of the defined scope do not add value to the project and should be tabled for a separate project.		
1.4.3	**Change Management**	Change management must take into account every aspect of the business – from the technical staff to the end users to the customers and other stakeholders.	• SAO: Effective Change Management: Doing Change Right: http://www.sao.state.tx.us/MAS/Newsletters/February2003/EffectiveChangeManagement.html • The Framework includes tools for Contract Amendment and Change Order Approval. http://www.dir.state.tx.us/pubs/framework/gate3/contractchange/index.htm	
1.4.4	**Corrective Action**	Corrective actions are any actions taken to bring expected future project performance in line with the project plan. Corrective action is accomplished by measuring performance and identifying the root cause(s) of any variations.		

1.5	Benefits Realization			
	DESCRIPTION		ISSUES	
	Benefits Realization is the culmination of Project Delivery and includes the measurement and evaluation of the project outcomes. This includes verifying the products and VoIP system; evaluating the performance of the VoIP Vender, and a final financial closure.			
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
1.5.1	**Contract Management & Closeout**	• When using an outsourced vendor, the project must be managed to the contract. Any changes to the scope of work or project must be reflected by changes in the contract. • Agencies should follow internal contracting procedures and guidelines when closing out the contract.	Benefit Realization tools are included in the Framework. http://www.dir.state.tx.us/pubs/framework/gate5/index.htm	
1.5.2	**System/Product Verification**	Vendor must meet or exceed requirement measures developed in Project Plan – particularly as it relates to Network Performance (see Technology)	Benefit Realization tools are included in the Framework. http://www.dir.state.tx.us/pubs/framework/gate5/index.htm	
1.5.3	**Vendor Performance Evaluation**	Vendor must meet or exceed requirement measures developed in Project Plan—particularly as it relates to Network Performance (see Technology)	Benefit Realization tools are included in the Framework. http://www.dir.state.tx.us/pubs/framework/gate5/index.htm	
1.5.4	**Administrative Closure**	Includes all administrative and financial activities to complete the project and technical work to verify that the VoIP system is acceptable. This section will include: • System verification • Financial closure • Lessons learned • Final Performance Reporting • Project archives	Benefit Realization tools are included in the Framework. http://www.dir.state.tx.us/pubs/framework/gate5/index.htm	
1.5.5	**Final Acceptance**	Final and formal sign-off that the project has been complete and the end product is acceptable.	Benefit Realization tools are included in the Framework. http://www.dir.state.tx.us/pubs/framework/gate5/	

			index.htm	
1.5.5	**Lessons Learned**	DIR Telecommunications Division will work with Agencies implementing VoIP to conduct analysis of successes and problems regarding: • Technology Issues • Project Planning Issues	Benefit Realization tools are included in the Framework. http://www.dir.state.tx.us/pubs/framework/gate5/index.htm	

2	**Technology**			
	DESCRIPTION		ISSUES	
	VoIP Technology refers to the hardware, software, cabling, configuration and the operational performance level of the equipment; as well as the ability of users to utilize the technology.		VoIP implementation requires a more robust network, increases security risks, and will impact the operation of existing telecommunications services.	
2.1	**Implementation**			
	DESCRIPTION		ISSUES	
	Technical Implementation of VoIP requires a network assessment of existing network infrastructure, any adjustments based on the assessment to ensure readiness for VoIP; and integration of existing hardware, devices, and services to the VoIP environment.			
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
2.1.1	**Network Assessment**	<u>Configuration & Cabling Assessment</u> • Operating System – Current Version of OS running on routers, switches, firewalls, and other devices must support VoIP. • Memory – RAM of Network devices must be sufficient to support VoIP functions. • QoS – QoS should be configured on IP routers and Ethernet switch. Network devices must support QoS mechanisms. • VLANs – Switches should support VLANs and 802.1p in order to segregate voice and data traffic on separate VLANs. • Shared LAN HUBS – No shared HUBS are recommended to ensure QoS. Upgrade shared HUBS to switches. • Interface Speed – Router interfaces should operate at speeds to support the number of VoIP calls to be utilized in network. Ethernet interfaces should support full-duplex.	Taking Charge of Your VoIP Project (Walker & Hicks, 2004), Cisco Press. http://www.ciscopress.com/title/1587200929	VLAN IEEE 802.1p http://www.networkdictionary.com/protocols/8021p.php IEEE 8021Q http://www.networkdictionary.com/protocols/8021q.php

		• Power Assessment – Power to the phone is a primary consideration with VoIP. Consider Power over Ethernet (PoE) if your platform supports it. Power requirements and backup (UPS) for network should be re-assessed before VoIP implementation. • Cabling Assessment – CAT 5e is highly recommended. New installs should employ Cat 6. • Environmentals – Network Room environmentals (HVAC) should be reassessed due to additional VoIP equipment, power consumption and heat dissipation. • Network Infrastructure – Some VoIP Features require multicasting. Assess your network for multicasting capability. <u>Utilization Assessment</u> Utilization statistics should be monitored for 7 days, 24 hours per day, for both average and peak values, to assess network devices and links. • CPU Utilization – CPU workload should be assessed to address potential problems with the addition of VoIP traffic. • Memory Utilization – Examine average and peak buffer utilization to prevent buffer depletion (dropped packets). • Backplane Utilization – Provides details about network traffic flow through the switch. • Dropped Packets – Analyze statistics related to dropped packets that point to unacceptable congestion and bottlenecks that cannot support VoIP traffic.	Taking Charge of Your VoIP Project (Walker & Hicks, 2004), Cisco Press. http://www.ciscopress.com/title/1587200929	

		• Interface Errors – Interface errors suggest faulty media. Check cable integrity. • Bandwidth Utilization – Throughput Testing end-to-end to determine what percentage of available bandwidth is being utilized.		
2.1.2	**Network Readiness**	Based on the results of a Network Assessment, network upgrades must be completed before VoIP implementation. VoIP requires QoS mechanisms for switches and routers throughout the network. Work with Vendor/Service Provider to determine best CODEC for Bandwidth needs. Consensus Industry recommendations are evolving for: • LAN (ITU G711) • WAN (ITU G729a) Chosen VoIP Vendor may require proprietary Protocol. For future planning, equipment purchases and compatibility considerations; recognize that the emerging consensus Protocol is SIP.	• Best Practices Handbook for Ensuring Network Readiness for Voice and Video over IP (Wainhouse Research) http://www.wainhouse.com/files/papers/wr-best-net-vnvoip.pdf • IP Voice Quality Network Requirements http://whitepapers.zdnet.co.uk/0,39025945,60021598p-39000515q,00.htm • Six Steps for Getting your Network Ready for VoIP http://www.voiptroubleshooter.com/appnotes/TechNoteSixStepVoIP.pdf	CODEC Protocols http://www.networkdictionary.com/protocols/g7xx.php
2.1.3	**Initial Testing/Turn Up**	*Interoperability and Integration Testing* – Consult with Service Vendor, or Hardware Vendor to test legacy network clients, devices, and applications that will be utilized in the VoIP environment.		
2.1.4	**Integration**	Consult with VoIP Equipment Vendors or Service Provider; as well as vendors for following equipment/services to ensure existing services will continue to function in VoIP environment. • IVR • Voice Mail • CTI	Switching to VoIP: Traditional Apps on the Converged Network http://searchenterprisevoice.techtarget.com/searchEnterpriseVoice/downloads/ch14OREILLYAUG05.pdf	

		• Directory Service • Collaboration Software • Intercom (overhead paging) • Alarm Systems • Emergency Phones (i.e. Elevator) • NICs • Faxes and Modems (In some cases, Agencies may want to retain analog lines) • Standards for Platform and Equipment (Existing devices must integrate with VoIP Vendor equipment)		
2.1.5	**Application Services**	Consult with VoIP Equipment Vendors or Service Provider; as well as vendors for following equipment/services to ensure existing services will continue to function in VoIP environment. • Numbering Plan (Agencies on CCTS should maintain current 5 digit dialing plan) • Unified Messaging • Feature Sets • CTI • Call Routing • ACD • Call Center Applications • CDR • Music on Hold (MOH problems develop across WAN due to bandwidth issues)	Switching to VoIP: Traditional Apps on the Converged Network http://searchenterprisevoice.techtarget.com/searchEnterpriseVoice/downloads/ch14OREILLYAUG05.pdf	
2.2	**Network Performance**			
	DESCRIPTION		ISSUES	
	Network Performance is the successful sustainability capability of the network to support VoIP, whether implemented by agency staff or provided as an outsourced service.			
	CATEGORY		REFERENCE	STANDARD, POLICY, OR GUIDELINE
2.2.1	**Quality of Service (QoS)**	Quality of Service is fundamental to successful VoIP operation. QoS should ensure Voice receives priority in terms of Class of Service (CoS) on the Network.	• Overcoming Barriers to High-Quality Voice over IP Deployments http://www.intel.com/network/csp/pdf/8539.htm	• CoS Technologies http://www.networkdictionary.com/networking/cos.php

		Components of QoS that should be monitored include: *Latency* – Latency in VoIP is the time it takes for a voice transmission to go from its source to its destination. The ITU recommends that the one way delay be no more than 150 ms *Jitter* – Jitter refers to the variation in packet delay. Rates of 30ms or less should be maintained. *Packet Loss* – The streaming nature of VoIP makes it intolerant of packet loss. Loss rates of 1%–3% are considered tolerable for VoIP. *Voice Quality* – There are a number of methods to subjectively and objectively measure voice quality in phone conversations. The mean opinion score (MOS) rating system scores quality from 1–5 with 3.5–4.0 deemed Toll quality.	• Understanding Latency in IP Telephony http://www.telephonyworld.com/training/brooktrout/iptel_latency_wp.html • In Depth: Jitter http://www.voiptroubleshooter.com/indepth/jittersources.html • Measuring Voice Quality http://www.voiptroubleshooter.com/basics/mosr.html • How to Measure Call Quality http://www.networkcomputing.com/shared/article/printFullArticle.jhtml;jsessionid=H1DTSRFFGTSFKQSNDBGCKH0CJUMEKJVN?articleID=59301493	• ITU P.800 http://www.networkworld.com/reviews/2006/022006-ssl-voip-test-side.html
2.2.2	**Service Level Agreements (SLAs)**	SLAs with service providers should require: • Measurable Deliverables – Measurable QoS to ensure quality of VoIP service. Vendor should provide detailed performance data and guarantee service and call quality. • MTR – Agreed upon response time to respond, repair and restore. • Escalation Procedures • Remedies, Enforcement and Penalty Provisions	• Business Class SLA for VoIP Services http://www.vertek.com/downloads/Business_Class_SLA_for_VoIP_Services.pdf • Service Level Management: Best Practices White Paper (Cisco) http://www.cisco.com/warp/public/126/sla.pdf	•
2.2.3	**Monitoring and Reporting**	Ongoing monitoring and reporting of network performance parameters must be maintained:		

		• Bandwidth Capacity and Utilization • Delay, Jitter, Packet Loss		
2.2.4	**Ongoing Capacity Planning**	Capacity Planning determines the amount of traffic the network can process; or in the case of VoIP, the measure of the number of phone calls the network can process. Network capacity is determined by the peak load – or the maximum volume the network will be able to handle.	Perform effective VoIP network capacity Planning (ZDNet) http://techrepublic.com.com/5138-1035-5926286.html	
2.2.5	**Ongoing Power Requirements**	*PoE* – VoIP requires power to the handset; Power over Ethernet (PoE) is recommended to distribute power to the desktop phone. Alternatively, power must be available to IP handsets via wall outlets at the desk. *Redundancy* – IT Infrastructure that supports VoIP must include redundant power: • Back-Up Generator • UPS with power time based on SLA	PoE Promises Simplified Infrastructure http://www.nwc.com/showArticle.jhtml?articleID=19200021	IEEE 802.3af http://www.networkworld.com/details/4681.html
2.3	**Security**			
	DESCRIPTION		ISSUES	
	Since VoIP utilizes the IP network, it becomes susceptible to the vulnerabilities inherent in data networks. VoIP security threats include Denial of Service (DoS) attacks, Call Intercepts, Toll Fraud, and Spam over Internet Telephony (SPIT).		Texas Administrative Code (T.A.C.) § 202 addresses state Information Security policies for agency data networks. National Institute of Standards and Technology (NIST) Special Publication 800-56; "Security Considerations for Voice Over IP Systems" details security issues related to VoIP.	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
2.3.1	**Physical Security**	*Site Security* – VoIP equipment and wiring closets should be sited and protected to reduce the risk from environmental hazards and unauthorized access. Cabling for VoIP should be routed in non-public areas to protect from interception or damage. VoIP equipment should be protected from	• Security Considerations for Voice Over IP Systems (NIST SP 800-56) http://csrc.nist.gov/publications/nistpubs/800-58/SP800-58-final.pdf • VoIP Security Alliance – Articles http://www.voipsa.org/Resources/articles.php • VoIP Security Alliance – White Papers	T.A.C. § 202 Information Security Standards http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=202&rl=Y

		power failures and other electrical anomalies. *Network Infrastructure* – Agencies should secure network infrastructure and maintain audit trail.	http://www.voipsa.org/Resources/whitepapers.php	
2.3.2	**Network Security**	*Network Architecture* – Separation of Voice and Data traffic through VLANs increases performance and security. *Authentication* – To protect the integrity of the network, the administration and management of a VoIP network must limit access to authorized users. Use authentication and access control on the Voice Gateway. *Encryption* – Utilize vendor provided encryption and/or VPNs as applicable. *IDS/IPS* – To mitigate external threats, utilize host and network intrusion detection/prevention systems. *Platform Hardening* – To secure IP telephony equipment, harden IP phones, desktops and servers, as well as call management software. *Firewall Protection* – Intelligent Firewalls should be utilized that understand Voice Protocols (H.323, SIP) *Patches* – Maintain patches and current versions of any VoIP software.	• Security Considerations for VoIP Systems http://csrc.nist.gov/publications/nistpubs/800-58/SP800-58-final.pdf • VoIP Security Alliance – Articles http://www.voipsa.org/Resources/articles.php • VoIP Security Alliance – White Papers http://www.voipsa.org/Resources/whitepapers.php	T.A.C. § 202 Information Security Standards http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=202&rl=Y
2.3.4	**Policies**	Agencies are required to have an Information Resources Security Program. Agencies must recognize VoIP as an added security risk and must develop rules to secure the VoIP infrastructure, equipment, and protect the privacy of conversations.		• T.A.C. § 202.20 – Security Standards Policy • T.A.C. § 202.71 – Management and Staff Responsibilities • T.A.C. § 202.27 – User Security Practices

				http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=202&rl=Y
2.3.5	**Compliance**	Federal regulations require agencies to project private information related to health care patients (HIPAA) and for education, student information (FERPA). Agencies implementing VoIP should sustain and, if needed, enhance security measures to protect private information.	• Liability Issues in a VoIP Environment http://www.lb3law.com/docs/02boothy.pdf • Security Challenges for CALEA in Voice Packet Networks (T.I.) http://focus.ti.com/pdfs/bcg/voip_calea_wp.pdf	• HIPAA http://www.hipaa.org/ • FERPA http://www.ed.gov/policy/gen/guid/fpco/ferpa/index.html • CALEA http://www.askcalea.net/
2.4	**9-1-1 Access**			
	DESCRIPTION		ISSUES	
	9-1-1 Emergency Telephone calls connects callers with emergency services to report emergency situations allowing for prompt response to location of emergency.		The existing 9-1-1 telephone infrastructure is devoted to traditional telephone system in the PSTN and VoIP calls do not have access to the systems Automatic Location Information (ALI) and 9-1-1 selective router to the Public Safety Answering Point (PSAP)	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
2.4.1	**Compliance**	The recommended best practice is to provide all callers Enhanced 9-1-1 service (E9-1-1). Current technology requires private switch ALI (PSALI) service to support E9-1-1 behind a switchboard. Future technology may allow E9-1-1 to be implemented without PSALI. Design for VoIP should consider Power requirements to ensure callers have access to E9-1-1 service during power outages.	• Liability Issues in a VoIP Environment http://www.lb3law.com/docs/02boothy.pdf • Switching to VoIP: Traditional Apps on the Converged Network http://searchenterprisevoice.techtarget.com/searchEnterpriseVoice/downloads/ch14OREILLYAUG05.pdf	• Health & Safety Code Section 771.060 – Provides “A business service user that provides residential facilities and owns or leases a private telephone switch used to provide telephone service to facility residents shall provide to those residential end users the same level of 9-1-1 service that a service supplier is providing to other residential end users in the area participating in the regional plan under Section 771.051(2).” E9-1-1 is the current level of service provided residential customer throughout the state. http://www.capitol.state.tx.us/statutes/hs.toc.htm • NENA State Status of PBXE 911 http://www.nena.org/9-1-1TechStandards/state.htm

2.4.2	**Enhancement**	Consult with Vendor/Service Provider to determine capabilities of 9-1-1 service including ALI.	• Enterprise Voice and E911 http://supercommnews.com/daily/wed/telecom_enterprise_voip/ • NENA Generic E911 Requirements Technical Document http://www.nena.org/9-1-1TechStandards/TechInfoDocs/E9-1-1%20Requirements%2008-502u.pdf	
2.5	**ADA/Accessibility**			
	DESCRIPTION		ISSUES	
	Accessibility allows the functional and operational features of information technology to be utilized by those with disabilities.		Texas state statutes require agencies to provide reasonable accommodations to employees with disabilities, including the use of information technologies.	
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
2.5.1	**Policy**	Agencies must consider the needs of disabled employees when implementing VoIP. Consult with Vendors before implementation to determine how products and/or services are accessible to disabled. The Network Design and VoIP equipment should support TTY, TDD	Voice Over Internet Accessibility http://www.inclusive.com/trng/voip/	• Government Code § 2054.456 – State employees with disabilities should have access to information resources comparable to those without disabilities. (See H.B. 2819, 79th Legislature) • American with Disabilities Act (ADA) http://www.usdoj.gov/crt/ada/adahom1.htm • Workforce Investment Act, Section 508 http://www.access-board.gov/508.htm • Section 1194.23 Telecommunications Products http://www.access-board.gov/sec508/standards.htm)
2.5.2	**Compliance**	Consult with VoIP product vendors to ensure: • All features available to IP Phone are accessible with TTY devices. • Callers are able to toggle between voice and TTY prompting. • Features such as Voice Mail, IVR, and	Addressing the Accessibility of TTY with VoIP http://www.comptalk.com/using_speech/Addressing_the_accessibility_of_TTY_with_VoIP.pdf	• T.A.C. § 213 Electronic and Information Resources • T.A.C. § 213.11 Telecommunications Products http://www.sos.state.tx.us/texreg/archive/November182005/PROPOSED/1.ADMINISTRATION.html#47

		Auto-attendant provide response alerts and sufficient time for response. • Calls that are forwarded to Voice Mail permit caller to leave TTY message. • Features with displays (Caller ID, etc.) provide text-to-speech conversion for visually impaired or blind employees. • IP phones should interface with hearing technologies and offer volume adjustment. • IP Packet Loss is below .12% for transporting TTY information reliably.		NOTE: THIS IS A PROPOSED RULE UNDER REVIEW

3	**Staffing**			
	DESCRIPTION		ISSUES	
	Staffing refers to the technical and management staff dedicated to a VoIP Project and the end users who utilize the network and VoIP equipment.		For VoIP Implementation, staffing issues may arise due to the involvement of diverse groups of technical and management staff : • Voice/Telephone Staff • Data Network Staff (LAN & WAN)	
3.1	**Technical Staff**			
	DESCRIPTION		ISSUES	
	Technical staff consists of the I.T. Staff responsible for operating, maintaining, and managing the hardware, software, and network to support the VoIP Project.			
	CATEGORY	BEST PRACTICE	REFERENCE	STANDARD, POLICY, OR GUIDELINE
3.1.1	**Training**	*For Outsourced VoIP Contract* – Service Provider should offer training to Technical Staff to allow for successful project management and technical troubleshooting. Training should be addressed in RFO and resulting contract. *For Insourced VoIP Contract* – Hardware Vendor should offer training to Technical Staff to allow for successful operations and technical troubleshooting. Training should be addressed in RFO and contract.	Acquiring VoIP Knowledge: Training Needs and How to Meet Them http://www.voip-report.com/wp_download/Acquiring_VoIP_Knowledge.pdf	
3.1.2	**Ownership & Responsibility**	Voice and Data Networking staff should be equal partners in VoIP project development, implementation, and operations. Depending on scope of project, both LAN and WAN staff should be represented on VoIP Projects. Representatives from Voice staff and Data Networking staff should be included in: • RFO development • Vendor review and award • Contract development • Project implementation • Ongoing operations		

3.2	Contract Management Staff			
	DESCRIPTION		ISSUES	
	Contract and management staff includes staff responsible for managing the VoIP Project Contract.			
	CATEGORY	BEST PRACTICE	REFERENCE	STANDARD, POLICY, OR GUIDELINE
3.2.1	**Ownership & Responsibility**	Contract Manager should maintain liaison with both Voice and Data Networking staff through initiation of RFO to project implementation.		
3.3	**End User**			
	DECSRIPTION		ISSUES	
	End Users include all staff utilizing VoIP as a result of project.			
	CATEGORY	BEST PRACTICES	REFERENCE	STANDARD, POLICY, OR GUIDELINE
3.3.1	**Training**	Training for End Users should be addressed in RFO and resulting contract. Training for End Users should address: • 9-1-1 dialing capability • Handset Power requirements • Feature sets and capabilities • Distinctions between VoIP phones and traditional telephones (voice quality, reliability, etc.)		

4 General References

Informational Web Sites

VoIP Trouble Shooter | http://www.voiptroubleshooter.com/

VOIP Wiki – a reference guide to all things VoIP | http://www.voip-info.org/wiki/

Publications

IP Telephony Pocket Guide (Shoretel) | http://www.shoretel.com/STCorp/promotional/documents/ShoreTel_White_Paper_VoIP_and_Productivity.pdf

Voice Over IP 101: Understanding VoIP Networks (Juniper Networks) | http://www.juniper.net/solutions/literature/white_papers/200087.pdf

VoIP and IP Telephony: Planning for Convergence in State Government (NASCIO) | https://www.nascio.org/publications/shoppingCart/index.cfm#VoIP

The VoIP Implementation and Planning Guide (United States Telecom Association, 2005) | Available from DIR Library

Taking Charge of your VoIP Project, Walker, J.Q. & Hicks, J.T. Cisco Press, 2004 | Available from DIR Library

VoIP Crash Course, Shepard, S., MacGraw-Hill, 2005 | Available from DIR Library